Province of British Columbia
Ministry of Forests

WILLIAMS LAKE TIMBER SUPPLY AREA

OPTIONS REPORT

CARIBOO FOREST REGION
BRITISH COLUMBIA FOREST SERVICE

JUNE 1989

APPROVED BY: _____ DATE: 30/6/89
H.A. CARLSON, R.P.F.
REGIONAL MANAGER
JUNE 30, 1989

90-03839/

PROLOGUE

The Options Report for the Williams Lake TSA is an intermediate step in the preparation of the Resource Management Plan for this area. The review of this report constitutes one of the opportunities for public input into the planning process. This report, and the responses received, will provide basic information for the development of a draft Resource Management Plan for further public review.

The Options Report contains a number of potential management choices and lists the foreseen impacts of each. This is not a complete list of the possibilities, but illustrates some of the choices. The purpose is to generate public response and comment and perhaps, through this, identify other necessary options. The Forest Service is seeking preferences on the options as the basis for the further development of the Resource Management Plan.

While the options presented in this Report tend to deal with timber, range and recreation concerns separately, it is important to note that the "option" which will eventually form the basis for a Resource Management Plan will integrate these Forest Service managed resources with each other as well as with fisheries, wildlife and other forest resources.

Responses will be reviewed and used by the Regional Manager in the preparation of a proposed Resource Management Plan for the consideration of the Chief Forester. The Chief Forester seeks an option which successfully deals with identified resource management issues. The Chief Forester's acceptance of the proposed Resource Management Plan, with or without ammendments, makes it a draft Resource Management Plan.

The draft Resource Management Plan will be subject to public review and assessment before the final Plan is recommended by the Regional Manager to the Chief Forester.

A Resource Management Plan, developed through this process and approved by the Chief Forester, will provide strategic direction to Forest Service resource management activities in the Williams Lake TSA for the next five years.

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1. INTRODUCTION

On March 8, 1985 the statement of Issues, Options and Procedures for undertaking a review of the production objectives for the Williams Lake TSA was approved by the Regional Manager. This document provided the focus for the numerous studies and analyses which were conducted in answering key questions affecting the TSA. These issues were defined through a process which solicited public input, forest industry input, and input from various government agencies.

On January 18, 1988 the Williams Lake TSA Information Report was issued. This document outlined the critical data assumptions made to address the various issues in the TSA. At about the same time, the Range and Recreation information reports were produced, summarizing information needed to address the issues defined for those resources in the 1985 Issues statement.

These works culminated in the release of the Williams Lake TSA Yield Analysis Report and Range Analysis Report and the conducting of a Recreation analysis. These documents show the production levels that can be achieved under a variety of scenarios and assumptions. These reports and the information gained from the analysis lead to the writing of the Williams Lake TSA Options Report. During this analysis process a number of factors were identified which have a significant impact on the final numbers; some of these factors are problems inherent in the system while others require further study. These points have been highlighted in a seperate document, "An Assessment of the Analysis Process".

The purpose of this Options Report is to further interpret the analysis results in order to show the major implications of pursuing alternative courses of action within the TSA. Furthermore, the document summarizes critical points that must be considered in deciding future directions. The aim is to solicit input on preferences as the basis for the Chief Forester to determine the preferred option.

With this decision made, a draft TSA Resource Management Plan can be written. A final plan will be produced after public review of the draft has been completed. The term of the eventual plan is five years, before its expiry a review will be undertaken to address any new resource management issues that face the TSA at that time.

Finally, as this is not a stand alone document, readers are referred to other reports mentioned above if further details on issues, data assumptions, analysis techniques or detailed results are desired.

Written comments and recommendations regarding the options presented in this report should be forwarded, no later than August 30, 1989, to:

Regional Manager, Attention: Planning and Inventory Officer
Cariboo Forest Region
540 Borland St.
Williams Lake, B.C. V2G 1R8

2. EXECUTIVE SUMMARY

One of the most significant results of the timber supply analysis is that the long run sustainable yield of the Williams Lake TSA shows an increase over that determined in the 1981 Yield Analysis (2 500 000 m^3/year). Furthermore, as the existing mature inventory of forest cover is harvested through the transition to a managed forest regime this TSA does not face an imminent falldown in timber supply. The Status Quo Option shows a rate of harvest of 3 445 000 m^3/year for the first decade before dropping to 3 125 000 for the remainder of the planning horizon.

There is a considerable interaction between range and recreation activities and timber harvesting in the TSA. This interface will be managed so that the needs of these resources can be handled through development planning. By changing the timing and amount of harvest in any local area, varying logging systems and silvicultural systems, and using landscape management techniques, the combined objectives of timber, range and recreation management will be achieved.

An analysis of range values within the TSA has shown that opportunities exist to either maintain or enhance the current level of range management within the TSA. In combination with timber harvest scheduling that incorporates range management concerns, the current program can maintain the annual production target of 230 000 animal unit months (AUM). An enhanced program could increase the allocation by up to 10%.

The recreation interface in the TSA is significant. Analysis of trends has shown that in the last three years, user days have increased by an estimated 12% annually for forest service sites and 21% annually for Forest Service trails. This is in balance with the buoyant economy and increased disposable incomes experienced in recent years. With this information, and a currently growing interest in wilderness, the recreation program requires increased planning efforts from this point on.

It has not been the purpose of this analysis to examine the possibilities for wilderness development within the TSA. Wilderness was not deemed a driving issue in 1985; furthermore the legislation enabling wilderness designation in Provincial Forests was not introduced until part way through this analysis and the wilderness policy has not been finalized. Notwithstanding these points, intensified wilderness planning and analysis is being undertaken through other avenues and will continue outside the TSA planning process. It is anticipated that this subject will be included in the next TSA review.

Historically, the total combination of silviculture activities in the TSA have not led to achieving basic silviculture. However, as a result of new legislation introduced in 1988, this situation has changed, and the establishment of free growing stands on all areas denuded is now required by law.

A comparison of the enhanced silviculture scenario to the required silviculture scenario shows that if all of the identified intensive forestry work is achieved, then the long run sustainable yield of the TSA could be increased by 176 000 m^3/year. This identifies an interesting and challenging opportunity to the management of the TSA, and merits further quantification, analysis, and rationalization in the future. A key factor here will be an emphasis on the development of managed stand yield tables to more accurately support this type of analysis.

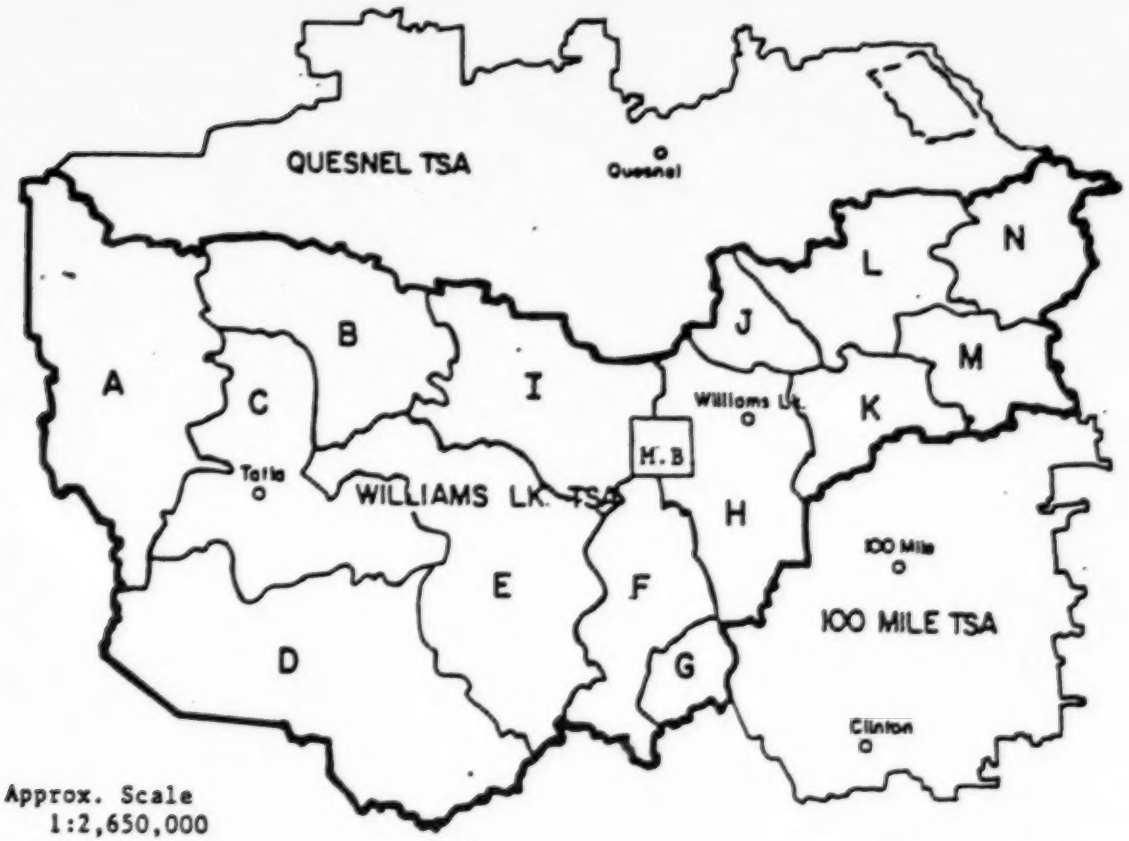
Another key point indicated by the analysis is the resilience of the TSA to the massive amounts of Mountain Pine Beetle damage which occurred in the late 1970's to mid 1980s. In that period, mountain pine beetle damage in the TSA was evident over approximately 700 000 hectares. Although not all of those areas contribute to the allowable cut, a net impact on the land base of 256 000 hectares of unsalvaged loss was projected in the Status Quo Option. This resulted in a loss of 41 000 000 m^3 of volume from the existing timber supply. In spite of these losses, the attendant regeneration delays and other associated problems, the analysis demonstrated that the existing harvest level can be met over the long term.

The impact of not harvesting a number of steep slope areas due to site sensitivity, operability constraints and adverse economics was examined. Not logging these areas, identified in the Williams Lake and Horsefly Districts, results in a reduction in the long run sustainable yield of 28 000 m^3/year and, due to the high existing volume on these sites, a 39 000 m^3/year reduction in the average long term yield. In order for these sites to be considered in the AAC, the commitment to increase the use of the specialized logging techniques, must be continued.

One of the most challenging and consequential issues currently facing the TSA is the successful integration of wildlife habitat needs into the overall planning framework. The wildlife options have had the greatest amount of time and effort spent on them, as they are the most complex to analyze, and also represent one of the most sensitive issues within the TSA. After much analysis, the Williams Lake TSA Steering Committee reached a consensus on an option that represented an operationally feasible compromise between specific wildlife habitat needs and timber harvest objectives. Pending future analysis and research, the effect on the long run sustainable yield would be 233 000 m^3/year.

In the remote area timber option, it is observed that if the Tatla, Anahim and Chilcotin supply blocks (supply blocks A, C and D) are included in the AAC calculation, the effect is to raise the LRSY by 779 000 m^3/year. However, the Itchas-Ilgatchuz caribou herd is noted to have special habitat requirements over some of the area and other areas are noted to be sensitive to development due to recreational values.

CARIBOO FOREST REGION



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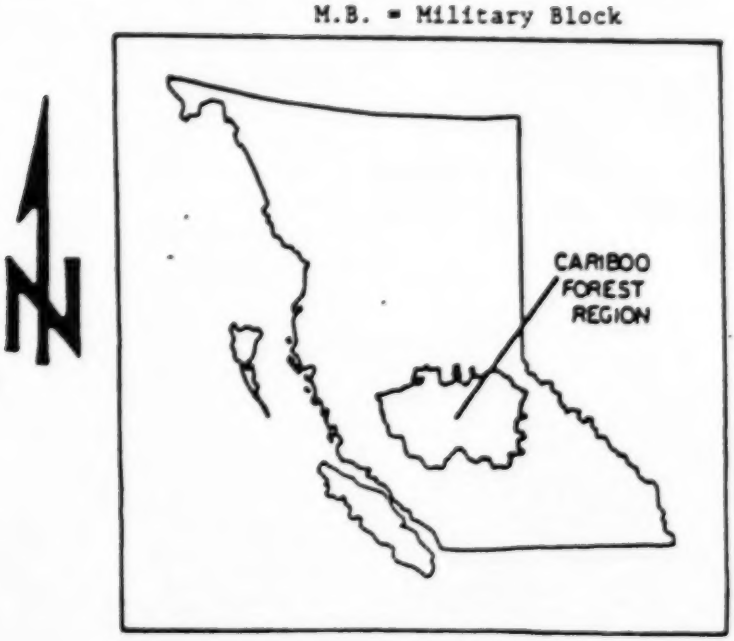
M.B. = Military Block



SUPPLY BLOCKS

- A Anahim
- B Chezacut
- C Tatla
- D Chilcotin
- E Kloakut
- F Gaspard
- G Churn
- H Springhouse
- I Palmer Lake
- J Skelton
- K Moffat
- L Cariboo
- M Upper Horsefly
- N Junction

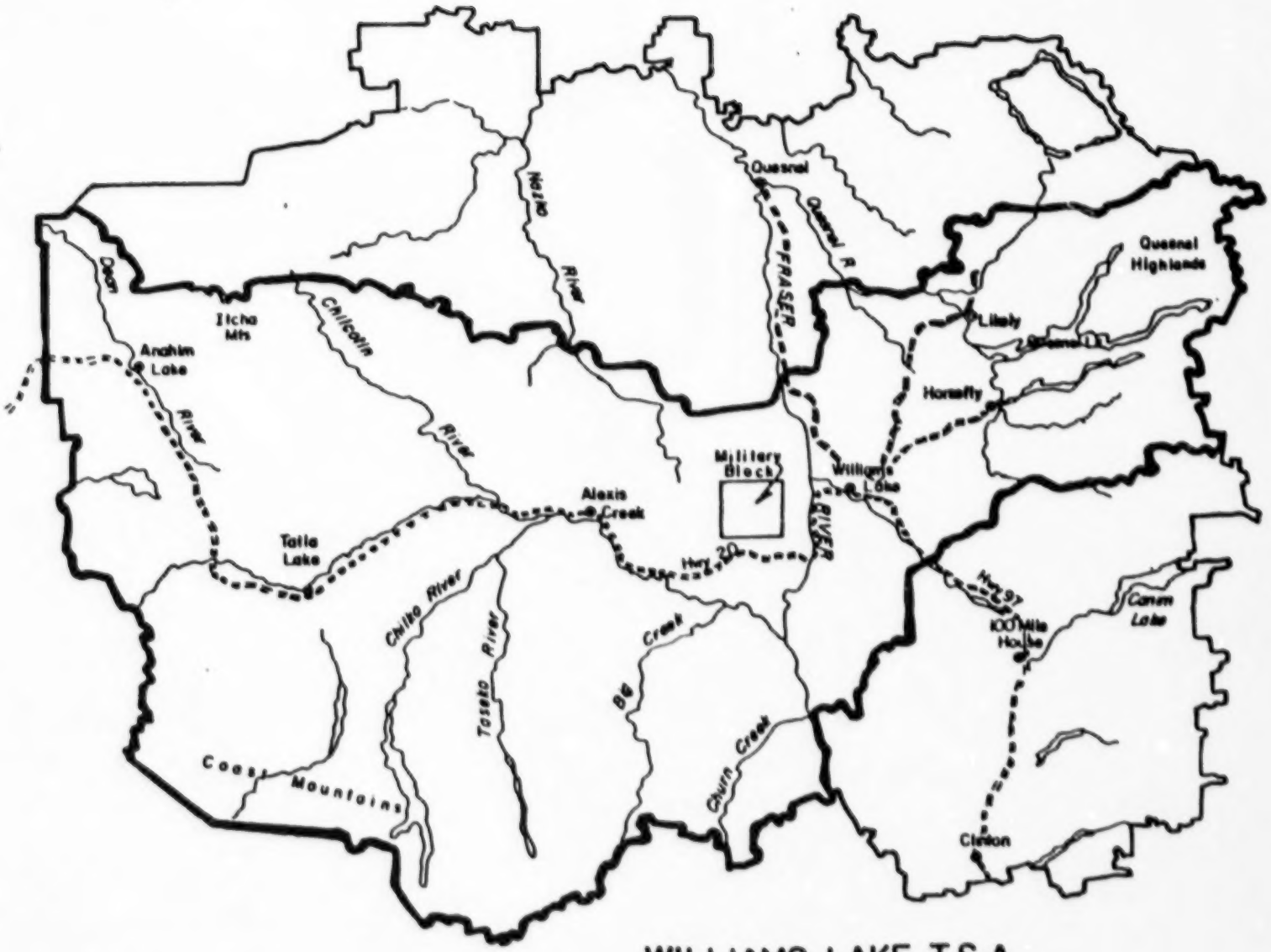


Figure 2. Williams Lake T.S.A. Map of Geographical Features

The implications to the TSA of removing the Churn supply block (supply block G) were also examined. Historically, this block has been economically marginal to develop to milling centers within this TSA, although this situation is beginning to change given improving market values, changes in stumpage calculations and improved access. If this block is removed, the LRSY would fall by about 35 000 m^3/year and the average long term yield would be reduced by about 43 000 m^3/year.

In summary, the TSA has the potential to remain strong in the area of timber supply. Whatever final production levels are determined to be appropriate for the area, the interactions facing timber, range, recreation, and fish and wildlife managers will be challenging and the planning requirements will be rigorous.

3. DESCRIPTION OF THE WILLIAMS LAKE TSA

The Williams Lake Timber Supply Area (TSA) is located on a section of the Fraser Basin and the Interior Plateau between Tweedsmuir Provincial Park and the Coast Mountains on the West and Wells Grey Provincial Park and the Cariboo Mountains on the East (figures 1 & 2). West of the Fraser River, the flat to gently rolling plateau is bisected by the Chilcotin River system and in the east the Quesnel Highlands gradually rise to meet the Cariboo Mountains.

The TSA encompasses a total area of 4 881 570 hectares. Of this, 3 353 894 hectares are productive Crown forest, the balance being either non-productive or under other forms of ownership. After consideration of other resource interactions on the forested area and of areas which are marginally economic for harvesting or manufacturing, the net land base being reviewed for supporting the allowable annual cut for the TSA ranges between about 1.5 and 1.7 million hectares. The TSA is sub-divided into 14 supply blocks as shown in figure 1. These supply blocks are discreet management units which are useful for summary purposes and for scheduling harvest activities or defining multiple resource interactions. The net land base used to support the AAC now in effect does not include the three western supply blocks: A,C and D.

This forest land base has a variety of demands on it. The local economy is dependant on the utilization of natural resources by industries for lumber production, cattle production, mining and recreation which includes hunting, fishing, camping and hiking. The primary employer for the TSA is the forest industry, including logging, log-hauling, sawmilling, reforestation activities and all the support services.

3.1 Supply and Demand for Resources in the TSA

Current resource supply and demand within the TSA are summarized as follows:

Timber:

Supply

The supply to the mills is based on timber provided from both crown and private timber purchases. Supply from private sources is unregulated and contributions from this area have risen in recent years and are expected to decrease in the future. Private timber primarily comes from newly developed land or from mature timber that is being liquidated. Much of the land suited for agriculture within the TSA has been alienated and the amount of newly developed agricultural land should decline. The recent mountain pine beetle infestation affected many private pine stands as well as putting the remaining pine in jeopardy, resulting in the liquidation of much private pine. Finally, much of the private wood is on ranches; due to the depressed state of the ranching industry much of this wood has been sold for operating capital.

The Crown timber supply from the Williams Lake TSA was 4 300 000 m^3 in 1987, based on an AAC of 3 750 000 m^3 and an additional cut of 550 000 m^3 in the 3 western supply blocks which do not contribute to the AAC. This AAC was raised from 2 500 000 for a period of five years starting in 1985 in order to salvage the pine killed by the mountain pine beetle infestation. This increased harvest will be re-evaluated prior to expiry in 1990, when it could be dropped.

The 1987 AAC apportionment within the TSA was as follows:

Replaceable Forest License volume -	2 246 200 m^3/year
Major Timber Sale License (replaceable) volume -	11 500 m^3/year
Woodlot Licence volume -	25 000 m^3/year
Non replaceable license volume -	1 267 300 m^3/year
Minor Timber Sale License volume -	200 000 m^3/year
Total	3 750 000 m^3/year

It should be noted that the non replaceable license volume includes the temporary increase of 50% to the AAC.

Demand

Mill consumption is used to indicate demand. Mill consumption in the TSA in 1987 was about 5 100 000 m^3, based on a review of mills operated by Forest License holders within the TSA. It should be noted that this estimate includes Carrier's mill in the Anahim Lake area, but operations were not at full capacity in 1987. In addition to this, there are some smaller operations, dependant upon private timber supplies, for which data is not available.

This consumption had increased considerably over the last five years, primarily due to the salvage of mountain pine beetle attack. In order to accommodate the increase in both private and crown timber, extra mill shifts were added and mill capacity was increased through modification.

Because the increased wood supply was predominately small pine stems, in some cases mill modification had to be combined with retooling and modernization and led to a considerable investment. This was accompanied by considerable changes in logging methods and logging and trucking equipment. The result has been a forest industry infrastructure that is geared to a wood supply considerably greater than the pre-1985 AAC of 2 500 000 m^3.

Range:

Supply

Current allocations indicate that 230 000 AUMs are authorized for use in the TSA. There is a fundamental problem with a large proportion of this available forage as it located away from the sources of demand.

Demand

Current utilization of crown range in this TSA is estimated at 214 000 animal unit months. Spring range is a critical limiting factor in some areas. If supply in these areas could be increased, the additional capacity would likely be utilized.

Recreation:

Current recreation demand in the Williams Lake TSA is very high, although existing information makes meaningful quantification impossible. Given the diversity of recreation experiences offered within the TSA, the demand level is expected to continue or increase in the future. With proper planning, it is assumed that most reasonable demands can be facilitated.

Crown Land:

In addition to the above resources, there are numerous other demands aiming at the disposition of crown land within the TSA, and these reduce the forest land base. The largest demand here is to provide land for agricultural purposes. Much of the most arable land within the TSA has already been alienated. Other demands for crown grants are to provide for homesites, recreation facilities, and industrial sites. Applications for crown land continue to total almost 2000 hectares per year.

Fish and Wildlife:

Fisheries values are high in the TSA. Recreational fishing use is heavy on many lakes and streams in the area and there are waters important to spawning salmon. Generally speaking, ungulate populations within the TSA are stable and their numbers are high. The utilization of these resources ranges from consumptive use to viewing and other recreational uses.

It is acknowledged that the requirements for the appropriate amount of suitable fish and wildlife habitat affects both day to day forestry operations within the TSA and long term timber yield.

3.2 Issues and Options Affecting The TSA

The 1985 Statement of Issues, Options and Procedures gave direction to the ensuing analysis. Most of the key issues identified at that time have been analyzed to some degree. As the analysis progressed, the emphasis on some of the original issues changed. The issues that emerged as most important are reflected in Options listed below.

A. Timber Supply Options

a) Status Quo Option - shows the consequences of continuing with the same assumptions as were applied over the past five years (1982 to 1987).

b) Management Opportunities Options - This group of options addresses a number of significant management issues within the TSA which have varying consequences given the changes in key assumptions. Briefly, these are:

Mountain Pine Beetle Losses Option - examines the possible impact of a worst-case Mountain Pine Beetle infestation on the existing timber inventory and the future timber supply.

Required and Enhanced Silviculture Options - assess the potential yield effects that might occur under varying silviculture activity levels for the TSA. The emphasis on and interpretation of these options has changed significantly with the introduction of new legislation governing silviculture activities.

Wildlife Habitat Options - study the interaction between sensitive wildlife habitat and various timber harvest strategies.

Remote Area Timber Options - examine the effect of removing the Churn supply block from the TSA as well as the potential contribution to yield from the Tatla, Anahim and Chilcotin supply blocks.

B. Range Management Options

These options examine the implications of various levels of range program activity within the TSA. The options considered are:
- Activity reduced to basic administration costs
- Activity continuance at current levels
- Current level activity with enhanced timber harvest scheduling
- Enhanced activity levels

C. Recreation Management Options

These options examine the ability of the recreation program for the Williams Lake TSA to meet demand and to fulfill all statutory obligations. The options considered are:
- Status quo administration
- Enhanced Management

4. PRESENTATION OF OPTIONS

All evaluated options will be presented in this section in a consist .t manner. The summary statistics are vitally important to the evaluation of the option and readers not familiar with some of the terminology are referred to the glossary of key terms at the end of this report.

4.1 Timber Options

It must be realized that the options presented can not all be viewed in isolation as viable courses of action. As stated in the Prologue, actual options for the future management of the TSA will be based on a combination of some of the options listed in this report. The options listed are either important as benchmarks from which to measure other options or are designed to show the sensitivity of altering any one assumption. The information from these options will be used as building blocks which can be assembled in any number of ways to examine the most likely management options for the TSA.

In interpreting the options, hard numbers are used wherever they could be produced. In other areas, such as the risk categories, a qualitative scale of low, moderate or high was used, as it was not possible to quantify the interaction being expressed. In many cases, an option was developed only with the intent of comparing the timber production potential with that of the Status Quo Option. In those cases the interactions with other resource uses were not analyzed and a meaningful interpretation of the option should not be made for certain parameters. For all options other than the Status Quo, a second column has been added to the summary statistics to show the percentage change from the Status Quo, or other options as appropriate.

Interpreting the risk values for an individual option does not have as much meaning as comparing between two different options. The values for risk are intended to be relative to one another, showing important changes between options, and as such are not good stand alone values.

Finally, the option numbers (such as Option 1. for the Status Quo Option) do not always coincide with the option numbers in previous documents. This is due to the amalgamation or elimination of the previous options as the process matured.

4.11 Option 1. Status Quo or Continuation of Historical Performance

Description

This option assumes the continuation of 1985 management activities, including harvesting practices, silviculture activities, pest management and harvest profile objectives. Subsequent to the development of the data for this option, legislation changes have changed the way that the status quo would appear if viewed in 1989. Therefore this can not be considered a viable option and is included only as the benchmark reference for comparing all other options.

Key Assumptions

1. Traditional cut and leave patterns will continue. The effect of cut and leave on the available timber supply is accounted for in the first 50 years of this analysis.

2. Basic silviculture will not be achieved. This is primarily due to funding limitations.

3. The historical percent harvest by species (as represented by the previous five years performance) is forecast.

4. Range and Recreation programs will be maintained at historic levels.

5. No special provisions other than scheduling and ESA netdowns will be used to account for wildlife habitat needs.

6. Some deductions in addition to ESA netdowns will be made to account for steep slopes and sensitive sites.

7. All mountain pine beetle killed stands which are not harvested will regenerate naturally with a maximum 20 year delay, with no expenditure of funds for site rehabilitation.

8. It is assumed that the land base currently being used to support forestry activities will remain stable over time. No allowance is made for significant withdrawals due to unforeseen alienations.

9. It is assumed that a portion of the existing immature inventory will become problem forest types, and hence will not contribute to either short term or long term yield. Approximately the same proportion of immature stands will be deducted as were deducted from the mature inventory.

10. The current temporary increase in the AAC of 50% is accounted for in the first five years of projected harvest within the TSA.

Summary Statistics

Status Quo Net Landbase	1 651 000 ha.
Initial Total Inventory	227 109 000 m^3
Average Long Term Yield	3 141 000 m^3/year
Long Run Sustainable Yield	2 920 000 m^3/year
Risk Of Disruption To Wildlife Populations	high
Risk Of Disruption To Forest Industry	Low (see implication #5.)

Implications Of This Option

1. This option would not provide sufficient protection of ex' :ing wildlife habitat to provide for maintenance of the Mule Deer and Caribou habitat required to meet Ministry of Environment, Fish and Wildlife Branch objectives. As stated in Appendix II, these objectives include 12,000 mule deer, 2000 western caribou and 400 eastern caribou.

2. Under this option, without any increase in past funding levels for silvicultural activities, timber production levels would fall within the TSA. However, with the introduction of recent forest legislation (see Option 2) this is no longer an issue.

3. The traditional harvest profile could not be maintained under this option. The limiting factor here is the availability of the Cedar-Hemlock trees. Other species could continue to be cut in the same proportion as that of the last 5 years if the AAC is close to the 1981 level.

4. The mountain pine beetle losses are at a level that does not affect long term yield significantly at this point. However, this depends on the assumption that all sites will regenerate with a 20 year delay, which is uncertain. Increased funding could facilitate increased yields if these sites were regenerated more promptly.

5. As explained in Section 3.1, at the moment many licensees have a temporary 50% increase in their harvesting rights to allow increased salvage of mountain pine beetle killed stands. If the licensees have to lose this additional annual allotment, there will be effects on operations and employment.

4.12 Option 2. - Required Silviculture

Description

This option assumes that basic silviculture is achieved through the provision of adequate funding and improved practices. Recent legislative changes have now made achieving the goals of this option a requirement and this option should be considered the current performance or status quo for silviculture activities. However, please note that all references to Status Quo Option refer to Option 1 as it is the benchmark option for comparison purposes.

Key Assumptions

1. An adequate level of silviculture activities to achieve free growing status on all denuded areas will be funded and carried out. Intensive forestry activities were not considered for this option.

2. All other assumptions are as per the Status Quo Option. This allows for clear interpretation of the benefits of achieving basic silviculture, or, conversely, the consequences of not achieving basic, as was assumed for the Status Quo Option.

3. Managed stand yield responses were based on best estimates of percentage gains that could be expected beyond natural stand yields.

Summary Statistics and % Change From Status Quo Option

Net Landbase	1 651 000 ha	--
Initial Total Inventory	227 109 000 m^3	--
Average Long Term Yield	3 194 000 m^3/year	+ 1.6%
Long Run Sustainable Yield	3 046 000 m^3/year	+ 4.3%
Risk Of Disruption To Wildlife Populations	see implication 5	
Risk Of Disruption To Forest Industry	see implication 6	

Implications Of This Option

1. This option illustrates the effects of achieving basic silviculture. A comparison of this option with the Status Quo Option shows that if the pre 1988 level of silviculture activities continued, it would have resulted in the cost of a TSA yield loss of 126 000 m^3/year when projected over the planning horizon.

2. Given recent 1988 changes in legislation, an impact on yield through failure to achieve basic forestry objectives is not expected in the future.

3. All activities required to create free growing stands on denuded areas will have to be carried out.

4. No intensive forestry activities will be achieved.

5. This option was not designed to show the timber interface with wildlife habitat needs. It is assumed that the implications to wildlife would be the same as those in the Status Quo Option.

6. The effect of achieving this option is that areas that have been logged will not produce yields less than those normally expected. The impact of the new forest legislation on the industry is the maintenance of yields at the price of additional costs that are now incurred by the industry.

4.13 Option 3 - Enhanced Silviculture

Description

This option assumes that basic and a defined level of intensive silviculture activities will be achieved. The objective is to show the effect on the long run sustainable yield of the intensive activities.

Key Assumptions

1. Funding levels are not considered as constraining, and therefore the defined level of intensive silviculture activities will be carried out.

2. All other assumptions are per the Required Silviculture Option. This allows for clear interpretation of the benefits of an increased level of silviculture activity beyond those inherent in the Required Silviculture Option.

Summary Statistics And % Change From The Required Silviculture Option

Net Landbase	1 690 000 ha	+ 2.4%
Initial Total Inventory	227 109 000 m^3	--
Average Long Term Yield	3 416 000 m^3/year	+ 7.0%
Long Run Sustainable Yield	3 222 000 m^3/year	+ 5.8%
Risk Of Disruption To Wildlife Populations	see implication 4.	
Risk Of Disruption To Forest Industry	see implication 5.	

Implications Of This Option

1. This option illustrates the benefits of increasing the level of silviculture activities beyond basic requirements. A comparison of this option with the Required Silviculture Option shows the actual gains attributed to intensive forestry activities. The LRSY can be increased by 176 000 m^3/year.

2. Further investment analysis will be required to better quantify the cost of this option, to prioritize areas of treatment and to justify the expenditures required to achieve this option.

3. Given the current uncertainty over managed stand response to intensive forestry activities, it is very difficult to quantify potential yield gains with any degree of certainty. The estimates used in this analysis are purposefully conservative so as not to overstate the benefits of intensive activities. Perhaps the greatest significance of this option has been the defining of the potential scope of such an intensive program. The final quantification of benefits may deserve further consideration.

4. This option was not designed to examine the interface with wildlife habitat. As it relies on assumptions from both the Status Quo and Required Silviculture Options, it is assumed that the implications to wildlife would be similar to those in the Status Quo Option.

5. The impact on the industry could be an improved outlook for timber supply.

4.14 Option 4 - Beetle Losses

Description

Four different scenarios were analyzed in order to produce this option. They examined the impact of the mountain pine beetle epidemic which ravaged the TSA in the late 1970's and early 1980s. Review of these scenarios helped quantify the impact of this infestation to date. A further step was taken to project the future potential losses of a worst-case continuance of the beetle epidemic.

This option primarily summarizes beetle scenario #4 (the worst-case scenario) as outlined in the analysis report. The other scenarios were used primarily as a sensitivity analysis to evaluate the implications of changing some assumptions and were designed to focus upon and support the final conclusions. They were also interim steps in determining the status quo unsalvaged loss numbers.

Key Assumptions

1. All key assumptions are per the status quo scenario, unless otherwise noted.

2. It is assumed that 25% of the unsalvaged mountain pine beetle sites will not regenerate satisfactorily without some form of treatment. These sites remain NSR in this option, while still remaining in the net land base, and the balance of the areas are assumed to regenerate satisfactorily after a 20 year regeneration delay.

3. It is assumed that further outbreaks will occur, and that a further 37 700 ha will be killed and not salvaged within the TSA over the next 20 years.

Summary Statistics And % Change From Status Quo Option

Net Landbase	1 651 000 ha	--
Initial Total Inventory	220 629 000 m^3	- 2.9%
Average Long Term Yield	3 039 000 m^3/year	- 3.2%
Long Run Sustainable Yield	2 823 000 m^3/year	- 3.3%
Risk Of Disruption To Wildlife Populations	see implication 5.	
Risk Of Disruption To Forest Industry	Moderate	

Implications Of This Option

1. Beetle scenario #3, from the sensitivity analysis referred to above, indicated that if 25% of the existing status quo unsalvaged beetle sites become NSR, then the TSA will lose 84 000 m^3/year of LRSY.

2. The TSA average cost of rehabilitation of the 25% NSR sites is estimated at $1000/ha. Therefore, the rehabilitation cost for only the NSR sites is $64 000 000. Further prioritized expenditures aimed at reducing the estimated average 20 year regeneration delay on the balance of the sites would give further yield increases by dramatic reductions in the regen delay period and also through the creation of managed rather than natural stands.

3. If the worst-case epidemic occurs, this loss could be as high as 97 000 m^3/year. For the worst-case, this exercise project . the next level of unsalvaged loss if a further mountain pine beetle epidemic should break out. This loss could be recovered through rehabilitation of the 25% NSR sites.

4. The road access developed during the last epidemic has and will continue to influence the quality of both the salvage logging program and the mountain pine beetle management program. Pheremone baiting, salvage logging, and liquidation of susceptible habitat are programs that must continue if we are to minimize further losses. This serves to reduce the probability of sustaining the worst case losses as referenced in point three.

5. This option was not designed to analyze wildlife habitat needs. As it is generally based on Status Quo Option assumptions, it is assumed that the implications to wildlife would be similar to those in the Status Quo Option. This situation is further aggravated by increased harvest levels, increased access and alteration of habitat diversity under this option.

4.15 Option 5 - Steep Slopes/Sensitive Sites

Description

This option examines the impact of not harvesting a number of steep slope areas, identified due to site sensitivity, operability constraints and adverse economics.

Key Assumptions

1. All key assumptions are per the Status Quo Option unless otherwise noted.

2 The Status Quo Option utilized the Environmentally Sensitive Area deductions and a small increment to account for the area of productive forest which would not see timber harvest due to site problems. In lieu of that deduction this option removed from the net land base a total of 22,358 ha. along the Fraser River valley (Supply Blocks F, G, H and J) and in the Quesnel Highlands (Supply Blocks L, M and N) that represented steep/sensitive sites.

3. Many of these sites may also have been identified as important wildlife habitat such as mule deer winter range. Therefore, some overlap may exist between this option and the Wildlife Habitat Protection Options (Options 6 & 7).

Summary Statistics And % Change From Status Quo Option

Net Landbase	1 634 000 ha	- 1.0%
Initial Total Inventory	223 594 000 m^3	- 1.5%
Average Long Term Yield	3 102 000 m^3/year	- 1.2%
Long Run Sustainable Yield	2 892 000 m^3/year	- 1.0%
Risk Of Disruption To Wildlife Populations	see implication 4.	
Risk Of Disruption To Forest Industry	Low to Moderate	

Implications of this Option

1. Timber production levels would be compromised within the TSA.

2. Traditional harvest planning has not demonstrated utilization of 100% of these sites. If they are included in the net land base then development plans must incorporate these sites and specialized equipment or techniques may be required to take advantage of them.

4. This option has the same implications for wildlife needs as the Status Quo Option. In addition, if these sites are harvested, some will require special measures to avoid damage to fisheries habitats.

4.16 Options 6 & 7 - Fish and Wildlife Options

These options examine the interactions between timber harvest activities and fish and wildlife habitat requirements. Habitat requirements for all fish and wildlife species managed by the Ministry of Environment were considered in the initial stages of this TSA analysis. For most species it was assumed that these requirements can be facilitated through existing forest management regimes and do not significantly constrain the short term timber supply or impact on the LRSY.

For both the western and eastern caribou herds the interactions involve both preserving a traditional range which can provide the animals with all habitat needs at each critical stage throughout the year and ensuring that an adequate food source is available during the winter months. For mule deer the interactions are focused on maintaining or enhancing important ranges needed for winter survival. The background information for these options is summarized in Appendix I.

Option 6 - Wildlife Habitat Option A

Description

This option accommodates the habitat requirements deemed necessary by the Ministry of Environment to maintain or reach regional wildlife population goals for mule deer and caribou with a minimal risk of disruption. As stated in Appendix II, these objectives include 12 000 mule deer, 2000 western caribou and 400 eastern caribou.

Key Assumptions

1. It is assumed that the needs of Fish and Wildlife species other than those referenced in this option, will be met through operational planning.

2. All key assumptions are per the Status Quo Option except that the status quo wildlife deductions were removed and replaced as follows.

3. For the eastern caribou area the option is marked by the exclusion of all timber harvesting above a high elevation line (see map Appendix 2) and for the western caribou the exclusion of all timber harvesting within an area encompassing the Itcha and Ilgatchuz Mountains and the upper Chilcotin River Plateau (see map Appendix 2). For mule deer this option calls for timber harvest constraints on all identified winter ranges.

4. The summary statistics for this option do not directly result from the analysis report because a greater reduction for western caribou was required than that analyzed. All numbers have been interpolated from the figures in the analysis report and are subject to a slightly higher degree of uncertainty.

Summary Statistics And % Change From Status Quo Option

Net Landbase	1 519 000 ha	- 8.0%
Initial Total Inventory	204 000 000 m^3	-10.2%
Average Long Term Yield	2 860 000 m^3/year	- 8.9%
Long Run Sustainable Yield	2 672 000 m^3/year	- 8.5%
Risk Of Disruption To Wildlife Populations	low	
Risk Of Disruption To Forest Industry	high	

Implications of this Option

1. Timber production levels would be compromised within the TSA. This option results in a combined reduction of 248 000 m^3/year to the long run sustained yield. Of the 8.5% total LRSY impact, approximately 2.7% is for eastern caribou habitat, 2.3% is for western caribou and 3.5% is for mule deer.

2. Forest industry operational and economic flexibility is severely disrupted. The TSA will see a shortfall of large diameter wood before second pass blocks become available, either creating severe impacts on the short-term ability of the wood profile to meet mill requirements or putting pressure on leave blocks and cut and leave patterns.

3. The mule deer winter range constraints have a significant impact on fir availability and development costs.

4.17 Option 7 - Wildlife Habitat Option B

Description

This option compromises on Option 6 while still accommodating the critical wildlife habitat requirements. By consensus agreement the Williams Lake TSA Steering Committee considers this option to be an operationally feasible compromise between specific wildlife habitat needs and timber harvest objectives.

Key Assumptions (condensed from August 2/88 Steering Committee Agreement)

1. All key assumptions are per Option 6, including the degree of analysis, except the Option 6 wildlife deductions were amended as follows.

2. For both the eastern caribou and western caribou areas some timber harvesting on approved locations is allowed within the areas identified as important for caribou habitat. This approved harvest activity within the caribou habitat area would be contingent on the following additional measures:

   - the remainder of the areas would be reserved from any other timber harvest pending further research or required management decisions regarding the animals habitat requirements, their interactions with timber harvesting and the importance of habitat in relation to other population regulating factors.

   - this reserving of areas not currently approved for harvest includes all areas that were netted down for other reasons such as merchantability. It must be noted that the timber referred to is only that within the identified caribou habitat areas as displayed in Figures 6 & 7, Appendix II.

   - access plans for the areas would be produced and the access restrictions required in the plans would be implemented.

3. For mule deer the constraints are reduced in specified low snowfall zones and are modified to allow for more selective harvesting in the other zones, contingent on the following additional measures:

   - detailed management plans for at least 28 of the winter ranges will be produced over the next five years. The present analysis has included the anticipated implications to the timber supply of these winter range plans.

   - in the interim, the habitat requirements for each winter range will be summarized in an overall matrix based on exclusions, deferrals, extended rotations and handbook logging.* This matrix will be used as a guide for timber harvest planning in each winter range until these detailed management plans can be produced.

* see footnote, page 20.

Summary Statistics And % Change From Status Quo Option

Net Landbase	1 554 000 ha	- 5.9%
Initial Total Inventory	208 600 000 m^3	- 8.1%
Average Long Term Yield	2 930 000 m^3/year	- 8.9%
Long Run Sustainable Yield	2 730 000 m^3/year	- 6.4%
Risk Of Disruption To Wildlife Populations	low to moderate	
Risk Of Disruption To Forest Industry	moderate	

Implications of this Option

1. Timber production levels would still be compromised within the TSA. This option results in a combined reduction of 190 000 m^3/year to the long run sustained yield; of the 6.4% total LRSY impact, approximately 2.2% is for eastern caribou habitat, 1.6% is for western caribou and 2.6% is for mule deer.

2. Forest industry operational and economic flexibility is adequate for short-term planning. Removal of the areas identified in this option would not improve the ability of the timber profile to match mill demand as they predominately involve larger diameter stems.

3. The mule deer winter range constraints would still have an impact on fir development and delivered wood costs. The final implications to fir availability in both the short and long term will not be known until the winter range management plans are completed.

4. Maintenance or enhancement of wildlife populations may become dependant on other measures such as predator control, habitat improvement or the ability to impose more strict hunter regulations following severe winters.

5. Continued research into wildlife habitat needs, particularily those for caribou, and the impacts of timber harvesting on wildlife habitat will be necessary both to avoid further conflicts and to better quantify the interactions between harvesting and habitat. Considerable resources from both Ministries of Environment and Forests as well as from the forest industry must be committed to this required wildlife research, or to develop management decisions where research is not available to answer management questions.

6. Ministry of Forests and Ministry of Environment commitment to the production and enforcement of access management plans must be continued.

4.18 Options 8 & 9 - Remote Area Timber Options

These options examine the implications of excluding or including some of the remote supply blocks in the TSA.

* Handbook for Timber and Mule Deer Management Coordination on Winter Ranges in the Cariboo Forest Region - Land Management Handbook Number 13 - Armleder, H.M., Dawson, R.J. and Thompson, R.N. - Ministry of Forests, 1986.

Option 8 - Inclusion of the Western Supply Blocks

Description

This option examines the impact of including the three western Supply Blocks (A, C and D) in the forest land base.

Key Assumptions

1. All key assumptions are per the Status Quo Option unless otherwise noted.

2. The entire gross land base for the Anahim, Tatla and Chilcotin Supply Blocks was added to the TSA gross land base. All management assumptions and net downs utilized in the Status Quo Option were then applied to this gross land base.

3. The wildlife habitat deductions used were calculated from the ESA information.

4. No extra deductions for recreation or other resource uses were used other than those calculated from the ESA information. These supply blocks are subject to considerable activity by other resource users and some additional deduction may be required to reduce the risk of disruption to those resources.

Summary Statistics And % Change From Status Quo Option

Net Landbase	2 237 000 ha	+35.5%
Initial Total Inventory	264 374 000 m^3	+16.4%
Average Long Term Yield	3 889 000 m^3/year	+23.9%
Long Run Sustainable Yield	3 699 000 m^3/year	+26.7%
Risk Of Disruption To Wildlife Populations	see implication 4.	
Risk Of Disruption To Forest Industry	low	

Implications of this Option

1. Timber production levels would be increased within the TSA, with a substantial additional volume added if these Supply Blocks were fully utilized.

2. The present mature inventory from these supply blocks is dominated by small stem lodgepole pine.

3. These Supply Blocks bore the brunt of the pine beetle attack and contain a large portion of the unsalvaged losses. Increased funding could facilitate increased yields if beetle sites were regenerated more promptly.

4. This option was not designed to analyze wildlife habitat needs. As stated for Options 6 & 7, the ESA deductions are not thought to be sufficient to adequately protect wildlife habitat and some additional deduction could be required to reduce the risk to wildlife populations.

4.19 Option 9 - Exclusion of the Churn Supply Block

Description

This option examines the impact of excluding the Churn Supply Block from the forest land base. Long haul distances resulting in high delivered wood costs and access difficulties have resulted in minimal harvesting in this supply block to date. Access improvement to portions of the supply block and recent changes in the stumpage appraisal system and lumber market have increased the feasibility of using this wood within the Williams Lake TSA, while a major bridge is still required before the supply block is fully accessed.

Key Assumptions

1. All key assumptions are per the Status Quo Option unless otherwise noted.

2. The Churn Supply Block contributes 82 300 ha. to the gross land base and 24 000 ha. to the net land base. This 24 000 ha. was removed from the net land base.

3. The wildlife habitat and steep slope deductions used to calculate the net land base were from the ESA information. Therefore, removal of this supply block from the net land base may result in some overlap with the deductions made in Options 5, 6 and 7.

Summary Statistics And % Change From Status Quo Option

Net Landbase	1 627 000 ha	- 1.5%
Initial Total Inventory	224 160 000 m^3	- 1.3%
Average Long Term Yield	3 098 000 m^3/year	- 1.4%
Long Run Sustainable Yield	2 885 000 m^3/year	- 0.9%
Risk Of Disruption To Wildlife Populations	not analyzed	
Risk Of Disruption To Forest Industry	moderate	

Implications of this Option

1. Timber production levels would be compromised within the TSA. The long run sustained yield would be reduced by 35 000 m^3/year.

2. The proportion of Douglas fir in this supply block is greater than the TSA average, therefore removal of this area would decrease the ability of the timber profile to match mill demand in the short term.

4.2 Section II. Range Management Options

The Range Management Options are geared around the key issues identified in the Statement of Issues, Options and Procedures dated March 8, 1985. These options show a different structure than the Timber Supply Options for two major reasons:

1. the key Range issues all represent constraints to the maximization of the use of the Range resource which can be reduced or ameliorated only through the increase of management activities. Therefore the Range Management Options represent four distinctive levels of management, dependant on three levels of activity, and their ability to address these key issues.

2. a mathematical system for analyzing the ability of varying funding levels to address the range issues is currently being developed by the Range Management Section of the Integrated Resource Management Branch. Until a standardized procedure of analysis is developed and the complementary data is produced the information will be presented in a simple format and all AUM and % numbers are approximate.

The four Range Management Options examine the ability of activity levels to address the following Range issues:

1. the Ministry of Forest's and the ranching industry's combined ability to provide the number of range improvement projects needed.

2. the impact on total production levels of a lack of adequate spring range and the potential for developing spring range.

3. the loss of productive rangeland through the encroachment of non-range vegetation as a result of natural succession and the ability to offset this loss through range improvements.

4. the loss of productive rangeland through the invasion of noxious weeds and the ability of the weed spraying program to combat this invasion.

For all four management options the following three points must be recognized:

1. no special deductions were made to production targets to account for interactions with fish and wildlife habitat needs. It is assumed that these interactions will be addressed in the future by a committee at the TSA planning level.

2. the implications of recent changes to forest legislation to the funding of range improvements, and to the use of the range resource have not been considered. Timber licensee participation as outlined in Pre-harvest Silviculture Prescriptions could have considerable implications.

3. considering the limitations outlined above, the AUM and percentage figures provided are best estimates only, based on staff experience and the limited data available.

4.21 Option 1. Basic Administration

Description

This option examines the implications of an activity level which would be adequate to cover basic administration only. This is not necessarily a viable option but is included as a benchmark reference.

Key Assumptions

1. The only activities funded would be issuing permits, collecting fees, processing transfers and leases, and minimal levels of range and other activity planning, monitoring and service to the public. It is estimated that this program would require a budget of $255 000 per year, based on the budget for the 1987/88 fiscal year..

Implications of this Option

1. Current Range production objectives of 230 000 aum/year could not be met, with an estimated AUM reduction within 10 years of between 15 and 20%.

2. The only range improvements in construction and maintenance, would be done by the livestock operators. Total expenditures for improvements could be expected to be only 5% of normal, subject to possible increases in operating costs and grazing fees. Much rangeland could not be effectively utilized particularly in critical years such as low water levels. Conflicts with other resources users, the public and resource managers would increase.

3. The quantity of useable spring range would decrease at about 0.5% per year with a proportionate decrease in stocking rates. Private hay fields would have to supply more of the spring range, further constraining the potential hay production.

4. Without some physical range improvements vegetation encroachment will reduce rangeland by 1% per year.

5. The Forest Service weed spraying program would be eliminated. This will mean an increase in weed populations and a resultant drop in carrying capacities of up to 10% after 10 years.

4.22 Option 2. Status Quo

Description

This option utilizes the activity level of the 1987/88 fiscal year.

Key Assumptions

1. The current level for all activities would be continued with the 1987/88 annual budget of $521 000 per year.

2. Limited consideration will be given for range management concerns in timber harvest scheduling.

Implications of this Option

1. Current Range production objectives of 230 000 AUM/year would slowly decrease.

2. With only limited coordination between timber harvest scheduling and range interests, the level of range improvement provided by current funding levels will not be sufficient to maintain the current carrying capacity and in the long run a drop of 1000 AUM/year could be expected.

3. The quantity of useable spring range would be maintained at current levels. Private hay fields would continue to supply much of the spring range, this would continue to constrain hay production.

4. Range improvement activity would not keep up with vegetation encroachment and, depending on the actual location, would only reduce the encroachment losses by 30 to 50%.

5. The Ministry of Forests Crown land weed spraying program would be continued and knapweed, the most significant noxious weed, would be contained to its current levels of damage. Biological control may be able to assist in the future if research by other agencies can be continued. This would enable the weed control program to be shifted to other noxious weeds in the TSA.

4.23 Option 3. Status Quo with Integrated Timber Harvest Scheduling

Description

This option utilizes the activity level of the 1987/88 fiscal year in combination with the full integration of range management concerns into the scheduling of timber harvesting.

Key Assumptions

1. The current level for all activities would be continued with the 1987/88 annual budget of $521 000 per year.

2. Timber harvest and stand tending scheduling which considers range management requirements would be used to enhance the available forage supply. This scheduling is aimed at timing the extraction of timber from any given area so that the range carrying capacity of that area remains static, providing a long run sustained yield of forage for range users.

Implications of this Option

1. Current Range production objectives of 230 000 AUM/year would be maintained.

2. The current levels of range improvement could be continued.

3. The quantity of useable spring range would be maintained at current levels. Private hay fields would continue to supply much of the spring range and this would continue to constrain hay production.

4. Scheduling of timber management activities would largely offset new losses to range caused by natural succession. This scheduling would permit funds to be redirected into vegetation encroachment problems on range through expanded burning programs and mechanical treatment of woody species, with a resulting increase in carrying capacity on these ranges of 5% per year.

5. The Crown land weed spraying program would be continued and knapweed, the most significant noxious weed, would be contained to its current levels of damage. Biological control may be able to assist in the future if research by other agencies can be continued, enabling the weed control program to be shifted to other noxious weeds in the TSA.

4.24 Option 4. Enhanced Management

Description

This option considers an enhanced activity level which would be adequate to increase range production objectives to a level sufficient to meet a projected increase in demand of 10%.

Key Assumptions

1. The current level of all activities would be continued or increased to an annual budget level $600 000 per year. A considerable amount of work would be required to determine the actual gains to be achieved and the best locations to implement the increased activity.

2. Timber harvest and stand tending scheduling which considers range management requirements would be used to enhance the available forage supply. This scheduling would be dove-tailed into enhanced range management practises to take full advantage of both.

Implications of this Option

1. Current Range production objectives could be increased approximately 10% to 250 000 AUM/year.

2. A greater number of range improvements could be provided. Stocking rates could be increased or maintained with better management of the resource, improved livestock control and reduced conflicts with other resource users. Projects could be implemented which are mutually beneficial to silviculture and range.

3. The quantity of useable spring range could be increased by about 3-4% per year through range upgrading, development of new range or better spring range management with improved control structures. Increased spring range could facilitate an earlier turnout which would increase stocking rates. This increase would relieve the demands upon private hay fields, increasing their production and allowing for the maintenance of larger herds.

4. Scheduling of timber management activities would largely offset new losses to range caused by natural succession. Further increases in funding could be put into countering vegetation encroachment problems on range through expanded burning programs and mechanical treatment of woody species with a resulting increase in carrying capacity on these ranges of 10% per year.

5. Knapweed would be contained to its current levels of damage, enabling the weed control program to be shifted to other noxious weeds in the TSA. Control of these other weeds, such as thistle, would further increase the range carrying capacity.

4.3 Section III, Recreation Management Options

The Recreation Management Options are geared around the key issues identified in the Statement of Issues, Options and Procedures dated March 8, 1985. The issues do not represent factors directly influencing the use or total supply of the recreation resource as do the timber supply options, nor do they offer the same opportunity for analysis as do either the timber supply options or the range management options. Therefore, these two issues have led to development of the two options.

The Forest Service's responsibilities for recreation management are limited to Crown land within Provincial forests. Other agencies, such as Parks Branch and municipalities, organizations and the commercial sector also provide recreation services and facilities. It is estimated that 75% of the recreation use within the Williams Lake T.S.A. involves Crown lands under the jurisdiction of the Ministry of Forests. This use can be broken into two major categories:

1. traditional uses dependant on the existing forest road network and recreation site system. These uses are generally compatible with other forest and range resource uses, given the current level of integrated resource use planning, however they depend on Forest Service funding to maintain or enhance the facilities.

2. emerging recreation uses such as river rafting, cross-country skiing and back-country hiking and skiing. These activities generally require the existing road and recreation site system only to access the resource and are not dependant on recreation funding to maintain facilities. However, these uses are dependant upon a certain type of natural setting and, because of a high potential for conflict with other resource uses, require a high degree of integrated resource use planning to ensure the preservation of these recreation opportunities. Much of the commercial recreation activity comes under this category.

4.31 Option 1. Status Quo Administration

Description

This option examined the ability of the Recreation program to fulfill its responsibilities to protect and enhance recreation values and to ensure the provision of safe and sanitary facilities in light of increasing expectations and demands.

Key Assumptions

1. Recreation program funding would be maintained at the current level of $450 000 per year.

2. Recreation use within the TSA will continue to increase over the next five years. It is estimated to have increased 280% from 1984 to 1986.

3. Current information suggests that demands from both the public and commercial sector for varied recreational opportunities will increase within Provincial forests.

Implications of this Option

1. Recreation production objectives within the TSA will be compromised. The ability to maintain existing facilities will not keep pace with either existing use or projected demand and recreation production objectives will not be able to be maximized. Increased forest access will heighten this problem.

2. Completion of detailed features inventory information cannot be realized. Without adequate recreation resource information, resource use will not be maximized and timber production targets could be compromised.

3. The level of user and demand information will not be enhanced. More information is needed on the demand for and the value of the recreation resource use before an optimum level of funding can be determined.

4. Conflicts will develop between Forest Service activities and other resource uses. Without adequate planning, resource use will not be optimized and timber and range production objectives may be compromised.

5. Conflicts will develop between Forest Service Recreation objectives and the activities of other agencies. These conflicts can result in directing recreation use away from existing facilities or increasing demand on existing facilities.

4.32 Option 2. Enhanced Management

Description

This option addresses the level of management necessary to realize statutory and policy obligations and to improve all other facets of the Recreation program.

Key Assumptions

1. All key assumptions are per the Status Quo Option unless otherwise noted.

2. Funding levels and staff commitment to the Recreation program will be doubled to an annual budget of $900 000/year. All currently active sites and trails will be maintained to prescribed standards. Eighteen new recreation sites and 17 new trails will be developed over the next five years.

3. The just completed inventory of the recreation resource, the Recreation Opportunity Spectrum, will be fully utilized in recreation and other activity planning.

4. The interactions between the Forest Service Recreation program and the activities and objectives of other agencies such as the Ministry of Environment will be addressed by a committee at the TSA planning level.

Implications of this Option

1. Recreation production objectives within the TSA will be increased so that the estimated current and projected demand for recreation use will be met.

2. Using the Recreation Opportunity Spectrum, key areas will be identified for protection of the recreation resource and the process of integration with other uses can be focused on these areas. Specific recreation management plans and landscape management plans will be formulated for these areas reducing conflicts between all resource users.

3. Conflicts will be minimized between Forest Service Recreation objectives and the activities of other agencies.

4. Increased user data will greatly improve the ability to manage the recreation resource to meet the demand. Further research work will be required to properly interpolate this data into projected demand.

5. Continued research will still be needed to assess the value of recreation use before an optimum level of service and facility can be determined.

5. SUMMARY AND COMPARISON OF OPTIONS

This section highlights important statistics for each of the options with the aim of giving the reader a quick reference guide from which simple comparisons of options can be made. This section is ended by a comparative graph of LRSYs (figure 3) and summary tables (figures 4&5) for the timber, range and recreation options.

The information presented here is only a partial expression of the total number of important statistics which may be meaningful to compare, depending on the interpretation being made. As such, this summary should be viewed as only partially useful in gaining information on certain trends, but by no means should it be considered as containing sufficiently comprehensive information to support the value of any one of the options.

It has been realized that the Williams Lake TSA does not appear to be headed for an imminent falldown. In fact, this analysis has revealed that the AAC could possibly be increased for this TSA; the Status Quo Option shows a rate of harvest of 3 445 000 m^3/year for the first decade before dropping to 3 125 000 for the remainder of the planning horizon.. This point has been proven out largely due to new data analysis techniques and the preparation of new growth and yield curves by the Inventory Branch of the Ministry of Forests. This AAC strength is due to the vast proportion of mature and over mature timber in the TSA which tend to mitigate the influence of both the volume loss to beetles, and the corresponding shift of these areas to younger age classes. However, because of this over mature timber the TSA remains susceptible to further losses from pests.

The range analysis has shown that in certain areas there is currently an under-utilization of AUMs. However, these AUMs are not located in the areas of highest demand and there are still areas which would benefit from further range improvements. Intensive planning of the forest harvest pattern could alleviate many of the range supply concerns through improving supply in the areas where demand is highest.

The review of the recreation program shows that the present program is not able to meet the current or projected demand for recreation use within the TSA nor is it able to meet all recreation planning obligations. An increased recreation information base and enhanced recreation program will provide adequate resources to perform all planning exercises required to integrate recreation resource protection with timber harvesting and other agency activities. An increased program will also ensure the ability to maintain all existing sites and trails, and to develop 17 new trails and 18 new recreation sites. This would bring the total program within the TSA to 88 sites and 24 trails by 1992.

The silviculture scenarios changed in significance over the course of the analysis. Given new legislation introduced in 1987 and 1988, the required silviculture option now represents the status quo, and the analysis shows that this improves the timber supply by an estimated 126 000 m^3/year. The intensive silviculture option shows a further potential improvement of 176 000 m^3/year.

The mountain pine beetle option examined the implications of experiencing a further epidemic as well as losing 25% of existing beetle sites as being productive without some form of rehabilitation treatment. If these events occur, the TSA will forego 97 000 m^3/year of long run sustainable yield, unless some treatment takes place. Further access development will help reduce the potential of this loss.

The steep slope scenarios, originally devised to examine the effects of excluding three levels of constraints due to steepness were consolidated into one option after cursory analysis showed only limited difference between the three. The implications here are that unless special consideration is given to the harvest of these sites, the TSA will lose a further 28 000 m^3/year of long run sustained yield.

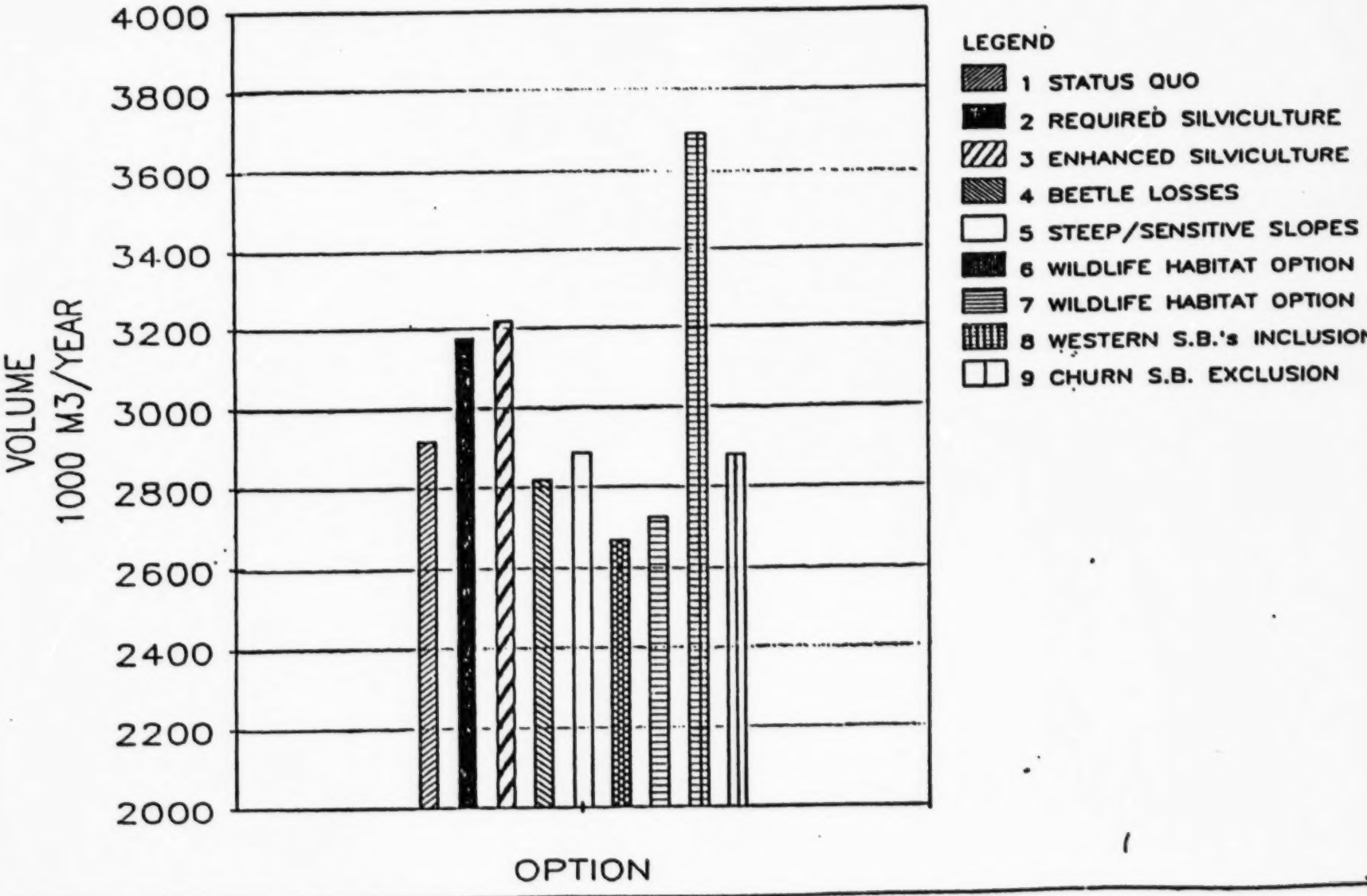
The wildlife options were complex to analyze, but show dramatic progress on assessing the interaction between wildlife habitat needs and timber production objectives. The implications of this issue became obvious to the many committees conducting the analysis, and much effort was put into defining the possible range of activities, the risks associated with each, and the impact on other resource production levels. The final figures used did not directly result from the MUSYC analysis report as they did for most other options because the information was modified during the ongoing process. However, valid best estimates were produced, including a LRSY impact of 211 000 m^3/year for the compromise option.

Option 8 examined the effect of including Supply blocks A, C and D in the setting of the AAC for the TSA. Historically, due to haul distances this area has been economically marginal to develop to milling centers within this TSA. This is changing due to stronger markets, improvements in log hauling and logging systems, improved access, extension of pavement on Highway 20, and with the introduction of sawmilling in the Anahim Lake area. However, operations in this area are recent in nature and the area does not have a long history of proven economic viability. Furthermore, the economics of the area have been further aggravated by mountain pine beetle damage, although this was not studied in detail for these supply blocks. Presently, significant short term activity has been undertaken and this will have to be considered in setting the AAC. Accordingly, any contribution to the AAC from these areas must take these factors as well as other resource users into account.

The contribution of the Churn supply block to the AAC for the TSA was examined in option 9. Although the long run sustainable yield contribution was listed as 35 000 m^3/year, it should be realized that this is a maximum. The calculation of this value did not consider the interaction between timber supply of this area and important mule deer winter range in Douglas fir stands. This interaction was accounted for in the wildlife scenario, but not in this option. If wildlife habitat becomes a consideration for this area, it may influence timber supply objectives.

Figure 3 compares the LRSY for each of the timber options and figures 4 and 5 summarize key factors for each of the options.

WILLIAMS LAKE T.S.A. OPTIONS
LONG RUN SUSTAINED YIELD



SUMMARY & COMPARISON OF TIMBER OPTIONS

		Option 1 Status Quo	Option 2 Required Silvi-culture	Option 3 Enhanced Silvi-culture	Option 4 Mountain Pine Beetle	Option 5 Steep Slope Sensitive Sites	Option 6 Wildlife Habitat 1	Option 7 Wildlife Habitat 2	Option 8 Include Blocks A, C, & D	Option 9 Exclude Block C
1.	Long Run Sustainable Yield (000 m^3/year)	2 920	3 046	3 222	2 823	2 892	2 672	2 730	3 699	2 885
2.	Average Long Term Yield (000 m^3/year)	3 141	3 194	3 416	3 039	3 102	2 860	2 930	3 889	3 098
3.	LRSY increase (+) or de... (-) over status quo ...) m^3/year)		+ 126	+ 302	- 97	- 28	- 233	- 211	+ 779	- 35
4.	Risk of Disruption to:									
	- Current Wildlife Populations	high	--- see	note	below	-----	low	low - mod	-- see	note --
	- Current Forest Industry	low	-----	-- " --	-----		high	moderate	-- " --	moderate
	- Current Recreation Program	low	-----	-- " --	-----		low	low	-- see	note --
	- Current Range Program	low	-----	-- " --	-----		low	low	-- " --	

1. Maximum long term regulated yield, including unsalvaged losses.
2. Yield over 0 - 200 years, less unsalvaged losses.
3. Summarizes change to status quo LRSY from option being evaluated.
4. Risk categories are a subjective evaluation of the interactions between various resources.

Note:
- Benchmark assumptions for each option are based on status quo assumptions, and modified where necessary to reflect the option being explored.
- Information in the table is provided only where it facilitates meaningful interpretation or comparison. Therefore values are left blank where the option in question was not specifically analysed for its interaction with the risk categories..
- Further elaboration on risks can be gained by reviewing the implications sections of the options as presented in the text.
- The important use of risk values in comparing between options for impact. As stand alone values they are subject to misinterpretation.

Figure 5.

SUMMARY OF RANGE AND RECREATION OPTIONS

1. RANGE OPTIONS

	Basic Administration	Status Quo	Integration	Enhanced
Animal Unit Months	184 000	210 000 to 230 000	230 000	250 000
Risk of Dis-Disruption to Cattle Industry	Moderate to High	Moderate	Moderate to low	Low
Annual Range Program Costs	$255 000	$521 000	$521 000	$600 000

2. RECREATION OPTIONS

	Status Quo	Enhanced Management
Conflict with other Resource Users	Moderate	Low to Moderate *
Risk of Recreation Program not meeting public demand	Moderate to High	Low
Annual Recreation Program Cost	$450 000	$900 000

* As explained on page 29, it is assumed that enhanced recreation activity would reduce conflicts through increased use of the ROS and improved planning and landscape management.

APPENDIX I

Wildlife Habitat Needs Background Information

APPENDIX I: WILDLIFE HABITAT NEEDS BACKGROUND INFORMATION

The Wildlife Habitat Options examine the interactions between timber harvest activities and fish and wildlife habitat requirements for four distinct wildlife units. The following is the background rationale for the habitat need considerations used in this TSA analysis. It must be emphasized that much of this information is based on limited research, just as is the understanding of the interactions between timber harvesting and these habitat needs. There is an identified need for continued research into the timber/wildlife interface in this TSA in order to better answer these questions.

Fish and Most Wildlife Species

It is assumed that the habitat requirements of these animals and any special practises that need to be carried out to accommodate them can be facilitated through existing management regimes. Habitat-related concerns center around maintaining a mosaic of habitats and should be met where necessary through modified field practises such as scheduling, deferrals and increased planning. These measures should not significantly constrain the short term timber supply and there is no need for exclusions or impacts on the LRSY specifically for these animals. Additionally, there is an anticipated overlap of these requirements with areas reserved for other wildlife species habitat or for other reasons such as ESAs, problem forest types, etc.

Western Caribou

Within the TSA, the Western Caribou herd resides in the Itchas-Ilgatchuz Mountains and a portion of the western Chilcotin Plateau (see map, Figure 6). In conjunction with the animals in the adjacent Tweedsmuir Park and in the Quesnel TSA it is considered one of the significant provincial caribou herds. The current total herd population is estimated at 1500 animals and it is felt that this population has increased substantially over the last 10 years. At present this herd suffers only limited mortality due to natural predation and has a significant capacity for population maintenance or growth to the Ministry of Environment's regional objective of 2000 animals.

This caribou herd is primarily dependant on terrestrial (ground-based) lichens as their major food source. It is speculated that only under infrequent conditions, which would not likely be for significant duration, would the caribou require an arboreal (growing on the trees) lichen food source. Current research seems to indicate that the animals are usually capable of 'cratering' through the snow to ground level to reach the terrestrial lichens. It is not currently known how long after logging or severe disturbance that these lichens will colonize an area well enough to represent a viable food source.

Conflicts with harvesting firstly involve maintenance of adequate winter range, thermal and protective cover as well as preservation of critical calving, post-calving and rutting areas. Secondly, a general North American trend seems to correlate declining or eliminated populations with increases in human activity which result from accessing an area.

Eastern Caribou

The Eastern Caribou herd utilizes the Quesnel Highlands area adjacent to Wells Gray Park (see map, Figure 7 for portion within Williams Lake TSA). For the entire Cariboo Region, the current population is estimated at only 250 to 350 animals, and is smaller than the number required to ensure long term genetic viability. Ministry of Environment's regional objective is a population of at least 400 to minimize the incidence of inbreeding.

There are a number of factors that may be limiting this herd's population size, including: existing habitat, wolf predation, road access, hunting pressure and poaching. The relative importance of these other factors versus habitat constraints has still to be determined; regardless of the answer to that question it appears that habitat preservation alone will not protect the caribou population and that continued wolf control measures are necessary.

The eastern caribou herd primarily feeds on arboreal lichen during the critical late winter period; standing trees are the major source of arboreal lichen and old growth climax forests appear to produce the maximum quantities of these lichens. Therefore a direct conflict with timber harvesting is the removal of the source of this critical food item with the cutting of old growth. Another conflict involves the opening up of traditional caribou range to increased hunter pressure and to increased wolf predation. Caribou are thought to space themselves widely as a strategy to minimize predation losses and any reduction in the total available range also increases the caribou density levels and also increases the risk from wolves.

Mule Deer

The mule deer herd utilizes critical winter range throughout most of the TSA. Current numbers are estimated to be in line with the Ministry of Environment's regional objective of a long term population of 12,000 animals for the Williams Lake TSA. It is known that the limiting habitat-related factor for population size in this TSA is the amount of winter range, the major other population regulator appears to be the hunter harvest, controlled and uncontrolled (poaching).

During the Cariboo winters mule deer utilize limited areas which provide lower snow cover, warmer temperatures and an acceptable food source. These winter ranges invariably coincide with old growth Douglas fir stands on south aspects. The large crowns of old growth Douglas fir growing in clumps appear to be unique in providing enough crown closure to ensure adequate snow interception for deer mobility. Douglas fir needles contribute up to 90% of the winter diet of mule deer in the Cariboo. Furthermore, these needles appear to be more palatable the older the tree is and it is only the older trees that are prone to limb breakage and that have sufficient litterfall to produce enough feed. Ground forage, if available, could also contribute to the winter diet.

In conjunction with the Ministry of Forests and the forest industry, the Ministry of Environment has identified 58 mule deer winter ranges on Crown land in the TSA. A considerable portion of possible winter range also lies on private land, but recent years have shown increased loss of deer habitat on private land due to expanded logging and agricultural development. The recent Mule Deer Handbook * has identified the actual forest components required for suitable mule deer winter range (such as crown closure) and management and harvesting techniques which can be used to manipulate these forest components.

* Handbook for Timber and Mule Deer Management Coordination on Winter Ranges in the Cariboo Forest Region - Land Management Handbook Number 13 - Armleder, H.M., Dawson, R.J. and Thompson, R.N. - Ministry of Forests, 1986.

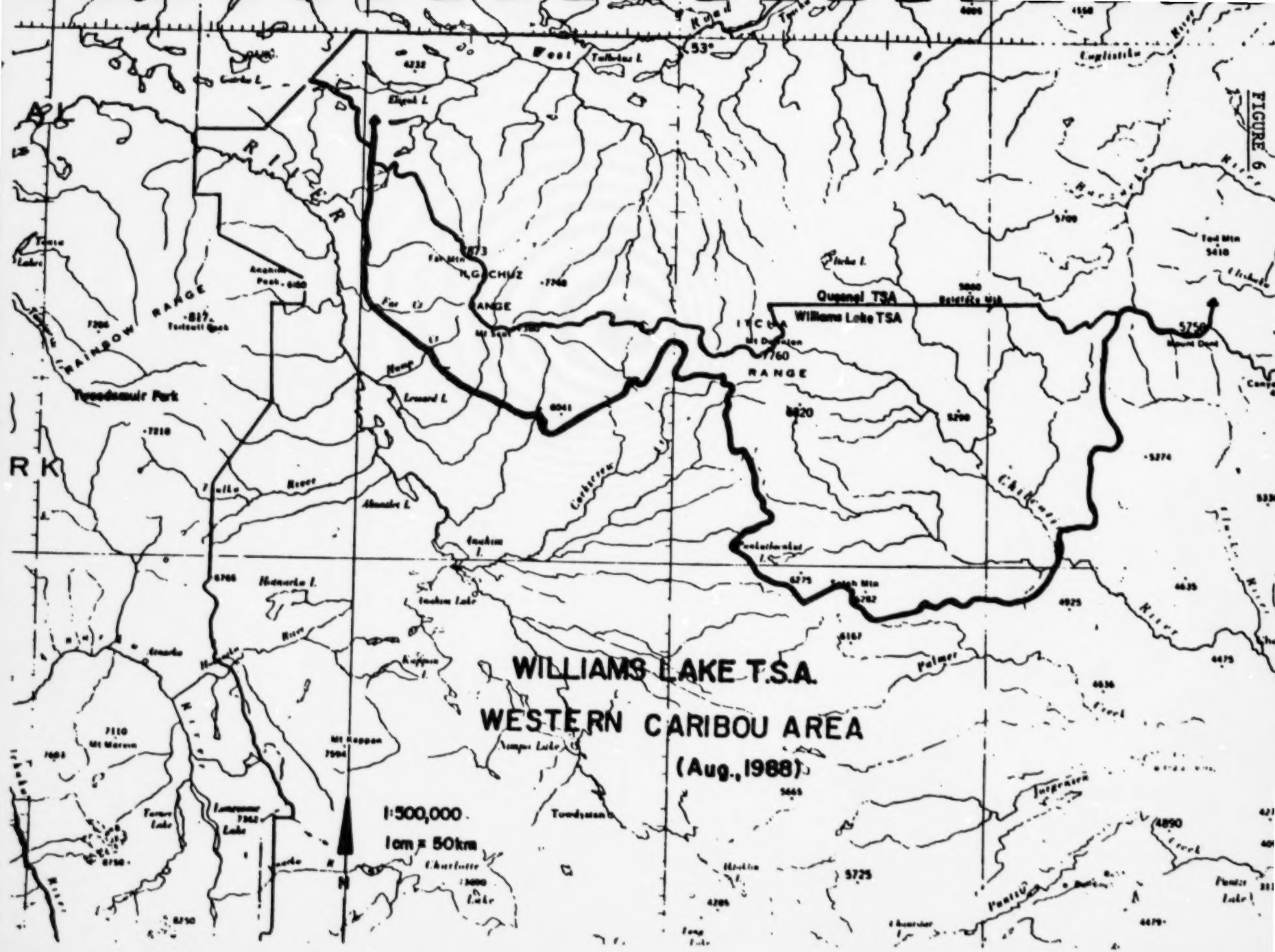
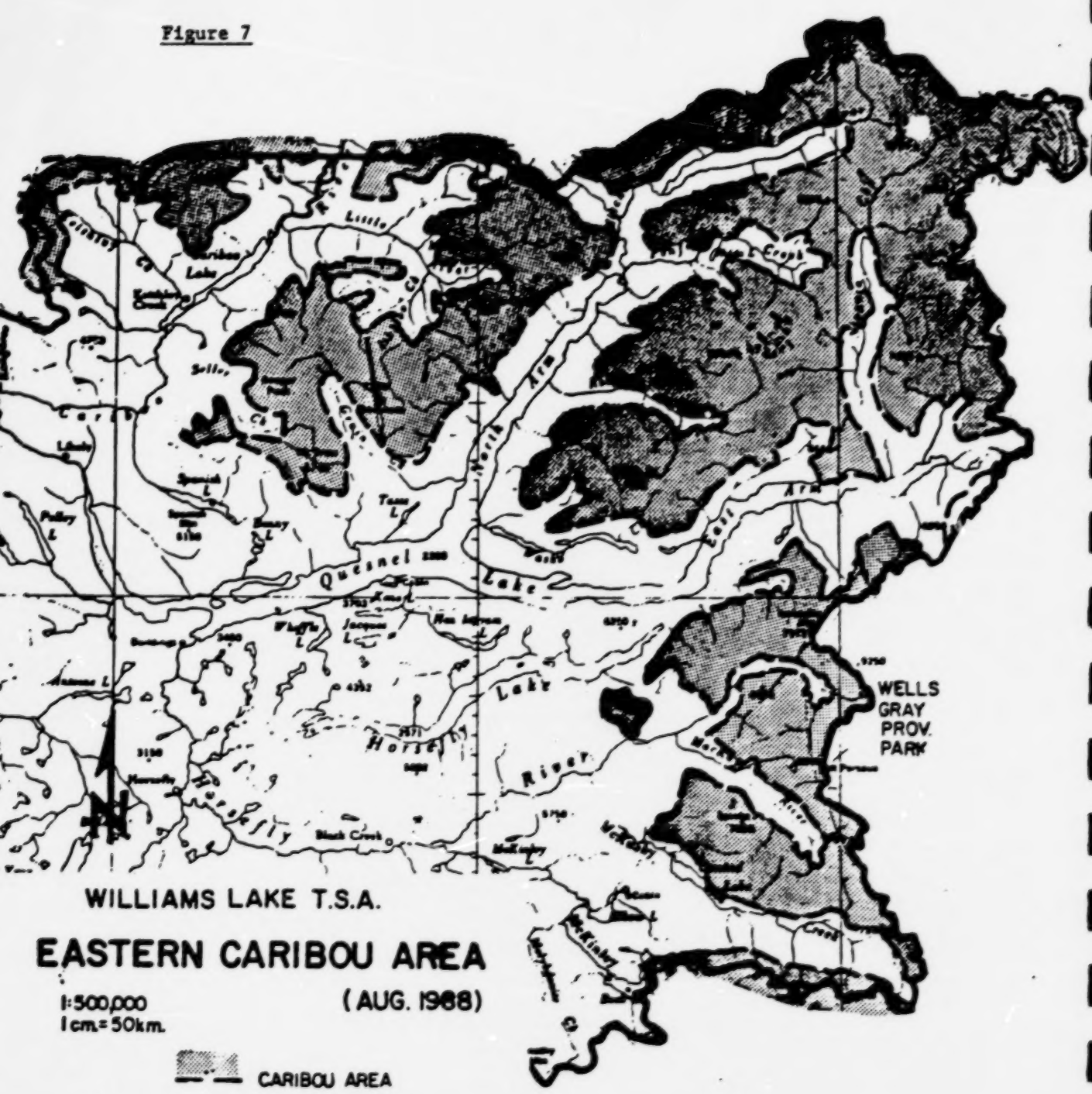

WILLIAMS LAKE T.S.A.
WESTERN CARIBOU AREA
(Aug., 1988)
1:500,000
1cm = 50km
Quesnel TSA
Williams Lake TSA
RANGE
Tweedsmuir Park
Taseko Mtn
Palmer
Tatlatui L.
Eaglestone
Tod Mtn
Mount Dent
Mt Kappan
Mt Morton
Tsuniah Lake
Tsacha L.
Chilcotin
Fraser
Pantage
Charlotte
Lonesome Lake
Farnum Lake
Hanson L.
Leonard L.
Elbert L.
Lucille L.
Anahim Peak
Rainbow Range
Ilgachuz Range
Itcha Range
Mt Davidson
Mt Tatlow
Fish Mtn
Tatlatui Prov. Park
Eaglestone Prov. Park
Rainbow Prov. Park
Ilgachuz Prov. Park
Itcha Prov. Park
Mt Tatlow Prov. Park
Tatlatui Prov. Park
Eaglestone Prov. Park
Rainbow Prov. Park
Ilgachuz Prov. Park
Itcha Prov. Park
Mt Tatlow Prov. Park

FIGURE 6

Figure 7



WILLIAMS LAKE T.S.A.

EASTERN CARIBOU AREA

1:500,000
1 cm = 50 km.

(AUG. 1988)

CARIBOU AREA

TSA BOUNDARY

APPENDIX II

Glossary of Terms

APPENDIX II. GLOSSARY OF TERMS

AAC Apportionment

The distribution of the AAC for a TSA among timber tenures by the Minister in accordance with Section 8 of the Forest Act.

Analysis Unit

The basic building blocks around which inventory data and other information are organized for use in forest planning models. Typically, these involve specific tree species or type groups that are further defined by site class, geographic location or similarity of management regimes.

Animal Unit Month (AUM)

The amount of forage required for one month by an average animal of the genus Bos (ie. a cow) aged 6 months or older.

Allowable Annual Cut (AAC)

The AAC is a schedule of planned rates of harvest set for a TSA for a 20 year period. (Term is also applied to the annual volume that can be cut from a forest licence.) The Forest Service reviews the AAC at least every 5 years.

Available Timber (see Operable Timber)

Timber which is available for harvest after due recognition of constraints to protect the environment and other forest uses.

Average Long Term Yield

The annual average of the total yield over the next 200 years minus unsalvaged losses. This figure is generally greater than the long run sustained yield due to the influence of cutting old growth timber in the first few decades.

Basic Silviculture

Maintenance of the productivity of forest sites, restocking of denuded forest lands with commercial tree species within 3 years for areas west of the Coast Range and 5 years for areas in the Interior, and including protection against damage by fire, insects and diseases to predetermined standards.

Ecosystem

Any complex of living organisms together with all the other biotic and abiotic factors which affect them that is isolated for purposes of study, e.g. a forest ecosystem is a part of a forest being uniform in climate, parent materials, physiography, vegetation, soils, animals, and microorganisms.

Environmental Protection Area (Environmentally Sensitive Area - ESA)

An area designated during the forest inventory process as being environmentally sensitive or critically valuable for other uses and consequently requires special attention.

Fall Down

When overmature forests are converted to managed forests, the new stands produce less volume, as they are harvested at younger ages. This reduction in volume over subsequent rotations represents the volume fall down.

Forest Licence

A licence authorizing harvesting on Crown Lands under Part 3, Division 2 of the Forest Act (1978). A Forest Licence has a term of 15 years (after initial replacement) and, specifies an annual allowable cut, requires a management and working plan, and specified management activities.

Free growing

As defined by legislation, a free growing crop means a crop of trees, the growth of which is not impeded by competition from plants, shrubs or other trees. Silviculture regulations further define the exact parameters that a crop of trees must meet, such as species, density and size, to be considered free growing.

Initial Mature Inventory

That portion of the existing total mature forest inventory which is available for harvest. This portion reflects all management constraints that are necessary to protect the environment and other forest uses and varies with the constraints identified for each option.

Integrated Resource Use

A decision-making process whereby all resources are identified, assessed and compared before land use or resource management decisions are made. The decisions themselves, whether to approve a plan or carry out an action on the ground, may be either multiple or single use in a given area. The application of integrated resource management results in a regional mosaic of land uses and resource priorities which reflect the optimal allocation and scheduling of resource uses.

Intensive Silvicultural Practice

Any silvicultural practice, or level of silvicultural practice, which in conjunction with basic silvicultural practices, constitutes an investment in securing future wood yields over and above those possible under basic silvicultural regimes.

Land Use Planning

The process by which decisions are made on future land uses over extended time periods, that are deemed to best serve the general welfare.

Long Run Sustainable Yield

The long run sustainable yield (LRSY) for any TSA is equal to the culmination of mean annual increment weighted by area for all productive and utilizable forest land types in that TSA including all not satisfactorily restocked, disturbed stocking doubtful, and potentially useable non-commercial cover.

Mean Annual Increment (mai)

The average amount of tree growth per year, calculated by dividing stand volume by stand age. The stand age at which the mai assumes its maximum value is called the culmination age.

Multiple Use

A system of resource use where the resources in a given land unit serve more than one user. Multiple use can be effected in three ways:

1. different uses of adjacent sub-areas which together form a composite multiple-use area,
2. the alternation in time of different uses on the same areas and
3. more than one use of an area at one time.

In multiple use planning, where differing resource uses are conducted at the same time on the same area and conflicts between users will occur, one resource is determined to be the dominant use and all other secondary uses are integrated only insofar as they are compatible with the first. Often multiple use planning sacrifices the production of the individual resources in favour of the over-all mix of resource uses that brings the greatest social and economic benefits.

MUSYC (Multiple Use Sustained Yield Calculation)

A linear programming forest planning model developed by the US Forest Service. MUSYC is currently used as the BC Forest Service's standard forest planning model for carrying out TSA timber supply computer analysis.

Net Down Procedure

The process of identifying the net land base, which is the number of hectares of forest land which actually contribute to the Annual Allowable Cut. The process involves "netting down" the TSA gross area to the TSA gross forest area then to the TSA net forest area. Areas and/or volumes are sequentially deleted or reduced from the gross land base for a number of considerations, including: private ownership, non-forest or non-productive, environmentally sensitive, unmerchantable and inaccessible.

Net land Base (see Net Down Procedure)

NSR (Not Satisfactorily Restocked)

NSR refers to an area where the forest has been more than 75% disturbed by fire, logging, etc. and has not been restocked to an acceptable level with commercial species.

Objective

The end result(s) that must be achieved through management at any given administrative level. Objectives are quantified and indicate time and agency responsibility.

Operable Timber

Available timber that can be economically logged with present harvesting methods after consideration of access, timber quality and market price.

Operational Plan

A plan detailing the logging techniques, location of roads and landing, and outlining other matters related to forest harvesting and forest crop renewal.

Option

A set of assumptions representing a possible management direction. Options are constructed as a normal part of a planning process in order to provide a framework for analysis and to facilitate management decision-making.

Planning

The determination of the goals and objectives of an enterprise and the selection, through a systematic consideration of alternatives, of the policies, programs and procedures for achieving them.

An activity devoted to clearly identifying, defining, and determining courses of action, before their initiation, necessary to achieve predetermined goals and objectives.

Planning Horizon

The time period which will be considered in the planning process.

Problem Forest Type

Non-merchantable forest types, including: stands of unfavorable stocking (ie. dense small trees), low productivity sites and decadent stands with high waste and breakage.

Public Involvement

The procedures for obtaining and considering the views of the general public in planning and decision-making processes.

Site Class

An assessment of the productivity of a forest site, determined by the combination of age and tree height for each existing tree species and expressed as either good, medium, poor or low.

Supply Block

An area of Crown land that is relatively homogeneous with respect to forest characteristics, access development and management concerns. Supply blocks are the next smaller timber management unit within a Timber Supply Area.

Trade-off

A management decision whereby there is a reduction of one forest use in favour of another, e.g. reduced timber yield in favour of improved wildlife habitat. In some cases a management decision favoring one use in one location, is offset by a reverse decision favoring another use in another location.

Timber Management Prescriptions

Recommended forest management practices, usually pertaining to the sub-unit and operational levels of planning.

Timber Supply

The available timber categorized by species, end-use, and relative value.

Timber Supply Area (TSA)

An area defined by an established pattern of wood flow from management units to the primary timber using industries.

TSA Plan

The forest management plan developed for a TSA. The TSA Plan establishes the overall direction for the management of the timber, range and recreation resources under Forest Service jurisdiction in the TSA.

Unsalvaged losses

The volume of timber destroyed by natural causes such as fire, insect, disease or blowdown and not harvested, including the timber actually killed plus any residual volume rendered non-merchantable.

Yield Analysis

The study of forest yield over time using mathematical models and inventory data.